Third Note on Faint Early Type Stars With Large Proper Motion

In the course of an investigation of the spectra of stars with large proper motion three more early type stars were found viz:

+34°2476	$9^m.3$	A	$13^h54^m.8$	+34°23′	0″.54
+35°3659	9 .5	A	19 27 .6	+35 57	0 .56
Furuhjelm 56	11 .3	A	21 41 .0	+43 51	0 .64

With the dispersion employed (6 mm from $H\beta$ to K) only a rough estimate of the radial velocity can be made. Measures of the hydrogen lines gave as results for the first two stars —220 and —180 km/sec respectively.

The identification of the last star was difficult as on the Franklin Adams chart two stars of nearly equal photographic magnitude are shown with a separation of about one minute of arc. The position of the north following component accords more closely with Furuhjelm's position and was therefore taken to be the proper motion star. The radial velocity was estimated from the hydrogen lines to be of the order of —350 km/sec which is another indication that the right star was observed. It must be emphasized, however, that —350 is only an approximate value and that it may easily be 80 km/sec in error.

Because of its large proper motion it is unlikely that this star is of the normal absolute magnitude of a Class A star ($+1^m.2$) for that would imply a space velocity of about 3000 km/sec. This consideration applies with equal force to the other two stars in the list, so that we are forced to regard them as stars of low luminosity. Apparently we shall thus have to admit the existence of A stars both of low luminosity and of excessive speed. However, it should be borne in mind that all three stars were selected for their large angular motion. It will be recalled in this connection that the star o_2 Eridani B (Class A) is intrinsically faint—the measured parallax of 0″.198 indicates an absolute magnitude of $+11^m.2$—and has a radial velocity of —40 km/sec and a space velocity of about 100 km/sec. It thus happens that all three radial velocities of these faint A stars are negative.

Two of the stars in my second list[1], viz., Wolf 1056 and C. P. D. —40° 7356 were observed with regard to spectral class

[1] *These Publ.*, **34**, 132, 1922.

and radial velocity. A spectrogram of the first star shows numerous metallic lines and a spectral class about G. The second star is classified as A0 in the Henry Draper Catalogue and in consideration of the proper motion and apparent magnitude it is probable that the star is a white dwarf (*loc. cit.*) Two plates obtained in May, 1922, fully confirm the Harvard spectral class and indicate only a small velocity in the line of sight.

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THE ROTATION PERIOD OF URANUS

In a recent paper Mr. H. Kaul[1] has derived an empirical formula for computing the rotation period of the great planets of our solar system. The formula used is:

$$R^2 = \frac{(1+rK-K)3}{ra^2}$$

where R denotes the number of revolutions of a certain planet during one terestrial day; r the equatorial radius and a the mean distance from the Sun; and K a constant dependent on the inverse of the planet's orbital velocity. The last term enters as an expression for the tidal friction (Gezeitenreibung) caused by the action of the Sun on the planet. As pointed out by Mr. Kaul the formula has a certain analogy with Kepler's third law.

By using values for r differing only slightly from the values as generally accepted, Mr. Kaul finds a complete agreement between the rotation times for the four great planets for which this quantity is accurately known from observation. The results are, perhaps, best illustrated by the following table, taken partly from Mr. Kaul's paper:

Planet	Rotation Period Observed	Rotation Period Computed	Value for r Used by the Comp.	Value for r Generally Accepted[2]
Mercury	?	imaginary	0.376	0.370
Venus	long period?	$26^h28^m53^s$	0.972	0.966
Earth	$23^h56^m\ 4^s$	23 56 4	1.000	1.000
Mars	24 37 23	24 37 23	0.530	0.540
Jupiter	9 50 0	9 50 0	11.277	11.140
Saturn	10 14 0	10 14 0	9.349	9.400
Uranus	10 50 0	13 45 18	4.000	4.000
Neptune	?	11 4 5	4.300	4.300

[1] *Physikalische Zeitschrift,* **23,** 184, 1922.
[2] Values taken from *Annuaire des Bureau des Longitudes,* 1922.